

Invasive Plant Risk Assessment and Analysis of Effects
Central Tongass Project Environmental Impact Statement
Petersburg and Wrangell Ranger Districts

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INTRODUCTION

The purpose of this Invasive Plant Risk Assessment is to provide a process to determine the risk factors associated with project activities in order to comply with Forest Service policy that directs all management activities be designed to minimize or eliminate the possibility of establishment or spread of invasive plants. The risk assessment is designed to develop and utilize site-based and species-based information to prioritize the management of invasive plants infestations in aquatic and terrestrial habitats. The analysis of effects incorporates the risk assessment and is part of the planning process required for proposed actions, especially for ground-disturbing and site-altering activities as well as public use activities.

This document follows direction from FSM 2900 Invasive Species Management (2011) and Executive Order (EO) 13112 (1999) as amended December 5, 2016. FSM 2900 provides National Forest System policy, responsibilities and direction for the prevention, detection, control and restoration of effects from aquatic and terrestrial invasive species that includes vertebrates, invertebrates, plants and pathogens. FSM 2900 is also referenced as guidance in the Tongass National Forest Land Management Plan for Invasive Plants (Chapter 4 - USDA 2016). The amended EO 13112 maintains the National Invasive Species Council (Council) and the Invasive Species Advisory Committee but expands the membership of the Council; clarifies the operations of the Council; incorporates considerations of human and environmental health, climate change, technological innovation, and other emerging priorities into Federal efforts to address invasive species; and strengthens coordinated, cost-efficient Federal action. The Guidance for Invasive Plant Management on the Tongass National Forest (Krosse 2017) outlines Weed Best Management Practices (Weed BMPs) recommended to reduce the risk of introduction and/or spread of invasive plants before, during or after project implementation.

Issues: No issues related to the invasive plants were raised during the scoping period for the CTP. The inclusion of invasive plant treatments in Alternatives 2 and 3 was done to allow for the following additional work beyond the *Wrangell-Petersburg Weed EA* (USDA 2013): 1) treatment on non-NFS lands to allow for partnerships and controlling plant species that are cross-boundary, 2) treatment of emergent vegetation (the 2013 Weed EA did not allow treatment over water), 3) adding broadcast spray as a treatment tool, and 4) removing the treatment cap (the 2013 Weed EA has a 200 acre annual cap, which is too small given that 182 acres were treated in 2017).

PROJECT DESCRIPTION

The purpose of the Central Tongass Project (CTP), as a landscape-level, condition-based analysis, is to comply with the Forest Plan goals and objectives and to support local and regional economies. The proposed Central Tongass Project (CTP) Environmental Impact Statement (EIS) includes all ground-disturbing activities that may occur in the next fifteen years. The intent of such an approach is to provide for an integrated, more cost effective and efficient approach to completing work. Activities were developed from identified needs, or areas where the desired conditions outlined in the 2016 Forest Plan do not match the existing condition. These activities have been lumped into four categories:

1. Watershed Restoration and Improvement which include but are not limited to fisheries enhancement, riparian restoration and invasive treatments.
2. Recreation Management covers maintenance of existing infrastructure, constructing or reconstructing infrastructure, or removing infrastructure.
3. Vegetation Management meets the need of providing timber, both old growth and young growth, as well as habitat improvements for fish and wildlife.
4. Access Management addresses the need to maintain a road system that supports management activities and public access.

Project Area: The 3.5 million acre CTP includes both National Forest Service (NFS) and non-Forest Service lands within the Wrangell and Petersburg Ranger District boundaries (Figure 1). The inclusion of non-Forest Service lands provides an “all lands, all hands” approach to watershed restoration and improvements. Invasive plants treatments are an example of where this tact makes sense given that invasive plants know no boundaries.

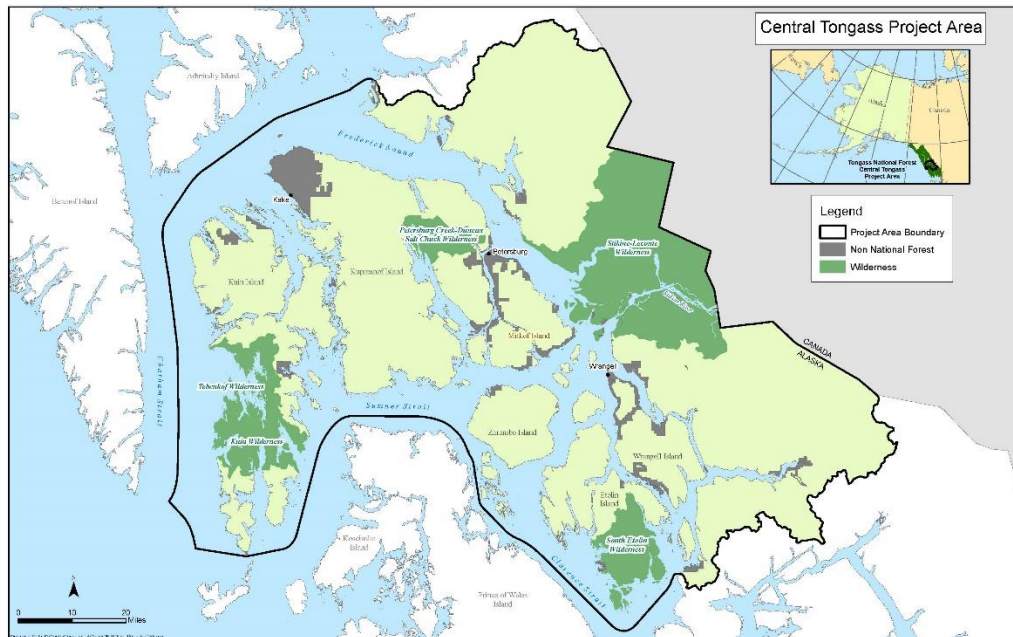


Figure 1: Central Tongass Project Area

Existing Condition

Eighty-nine different invasive plant species cover an estimated 5,811 gross acres within the CTP area. AKEPIC data was combined with NRIS data to ensure that all documented infestations were accounted for and not counted twice (Heuette 2019). Two (three) aspects of this 5,811 acres to keep in mind (the existing condition of our data):

1. **Gross acres** Gross acres is defined as the entire area delimited by the extent of the plant species regardless of the percent cover, as opposed to **canopy acres** which is calculated based on the area of actual plant cover within the aerial extent (Figure 2). Using the average percent cover available for invasive inventory (a crude calculation), the total canopy acreage within the project area is roughly 697 acres.

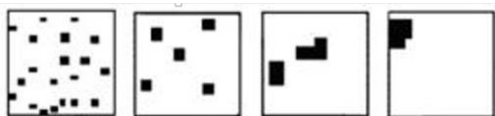


Figure 2: Outside boundary would be considered the gross acreage whereas the black squares within the box would be considered the canopy acres. In this example, with a 1 gross acre mapped (the square), and 5% cover (the black squares), the canopy acres = 0.05 acre.

2. The data set used is only an estimate. Inventory work conducted in 2006, 2007 and 2012 collected point data along the road system, the SEAPA powerline corridor and at borrow pits/marine access facilities. This data was then represented spatially as a polygon based on the rough acreage every quarter mile; therefore, the data gives reasonable presence/absence data but does not tell you about the invasives infestation in between sample points. This presence/absence information has been used to map continuous polygons along roads for reed canarygrass and orange hawkweed where present on NFS lands. Lastly, this data contains other inventory work over the past two decades that maps an entire infestation as a polygon.
3. Due to the spatial overlay of the shoreline with the infestation data points, roughly 1,000 gross acres of the 5,800 is not included in the island/LUD/site type tabular presentation. Most of this is within the Duncan Salt Chuck (brass buttons) and where State highway parallels saltwater on Mitkof and Wrangell Islands.

Of these 5,811 gross acres, 20 species with an estimated 4,335.7 gross acres are ranked moderately invasive or higher by the Alaska Center for Conservation Science (ACCS 2019) (Table 1). The ACCS ranks invasiveness based on the biology of the species, ecological impacts, distribution within natural areas/human role as a vector, and feasibility of control (Carlson et al. 2008). Five are ranked as highly invasive (≥ 80), including two knotweed species (*Fallopia x bohemica*, *Fallopia japonica*), reed canarygrass (*Phalaris arundinaceae*), spotted knapweed (*Centaurea stoebe*), and one infestation of giant hogweed (*Heracleum mantegazzianum*). The majority of the estimated gross acreage is reed canarygrass with 3,805.8 gross acres. Five species are ranked as highly invasive (70-79), including two of the hawkweeds ranked at 79 and covering an estimated 173 gross acres (*Hieracium aurantiacum*, *Hieracium caespitosum*). The remaining 11 species are ranked as moderately invasive. The complete list of 89 species is listed in Appendix A.

Table 1: Invasive plants within the CTP ranked as moderately invasive or higher.

Species	Gross Acres	Rank	Where found/Treatment if any
Knotweed (<i>Fallopia japonica</i> and <i>Fallopia x bohemica</i>)	20.3	87	Tarp treatment in Stikine – Leconte Wilderness; Herbicide treatments at NFS admin site, on NFS land, and on non-NFS lands
Spotted knapweed (<i>Centaurea stoebe</i>)	0.09	86	Hand-pulled on NFS and non-NFS lands at Kake, thought eradicated
Reed canarygrass (<i>Phalaris arundinaceae</i>)	3,805.8	83	Hand pulling in Petersburg Creek – Duncan Salt Chuck Wilderness and along lower Raven Trail; Herbicide treatments at admin sites, in riparian restoration sites, along select road systems, and along the river in the Stikine-LeConte Wilderness
Giant hogweed (<i>Heracleum mantegazzianum</i>)	0.001	81	Non-NFS lands, one location only
Orange hawkweed (<i>Hieracium aurantiacum</i>)	200.8	79	Tarp treatments in S. Etolin Wilderness and at SUP sites; Herbicide treatments at NFS admin sites and along select NFS roads
Meadow hawkweed (<i>Hieracium caespitosum</i>)	1.3	79	Herbicide treatments at NFS admin sites and along select NFS roads

Canada thistle (<i>Cirsium arvense</i>)	0.1	76	NFS and non-NFS lands, roadside
Field sowthistle (<i>Sonchus arvensis</i>)	0.1	73	non-NFS land, roadside
Creeping buttercup (<i>Ranunculus repens</i>)	31.5	72	NFS and non-NFS lands, road shoulder and recreation sites
Bigleaf lupine (<i>Lupinus polyphyllus</i> ssp. <i>polyphyllus</i> var. <i>polyphyllus</i>)	0.08	71	non-NFS land, road shoulder
Scotch broom (<i>Cytisus scoparius</i>)	0.1	69	
Robert geranium (<i>Geranium robertianum</i>)	0.1	67	Hand pulling on non-NFS land, road shoulder
Pale yellow iris (<i>Iris pseudacorus</i>)	0.4	66	Digging on NFS lands, recreation sites, thought eradicated
Bird's foot trefoil (<i>Lotus corniculatus</i>)	0.5	65	NFS and non-NFS land, road shoulder
Tall fescue (<i>Schedonorus arundinaceus</i>)	6.7	63	NFS and non-NFS lands, road shoulder
Stinking willie (<i>Senecio jacobaea</i>)	0.1	63	non-NFS land, road shoulder
Smooth brome (<i>Bromus inermis</i>)	0.4	62	NFS and non-NFS lands, road shoulders
Oxeye daisy (<i>Leucanthemum vulgare</i>)	276.9	61	Human disturbance on NFS and non-NFS lands: homes, road shoulders, admin sites
Bull thistle (<i>Cirsium vulgare</i>)	6.1	61	Digging up on NFS land, road prism; non-NFS lands road shoulder

Humans have been the most significant vector for the introduction of invasive plants within the project area. Communities are invasive hotspots -- Wrangell with 65 different species, Petersburg with 53 and Kake with 52. Roughly 1,117 gross acres are documented on non-NFS lands, with surveys focusing on communities and state highways. Quite typically the spread radiates out from these sources gradually over time as people recreate and work across the landscape. Knotweed is a species of concern regarding spread, as the shrubs are predominantly located within the communities proper. However, small infestations have been documented in the Stikine-LeConte wilderness and islands outside of Wrangell.

Reed canarygrass, on the other hand, was utilized in the seed mix for erosion control, which is apparent when viewing the distribution along the road corridor. Because of the seeding along the road system, this is one species that is moving into riparian corridors as wind and water transport the seed from road stream crossings. There are presently 443 gross acres inventoried within the riparian management area; however, the majority of these gross acres are at stream crossings and not downstream within the stream corridor (Figure 3).

Brass buttons (*Cotula coronopifolia*) in the Petersburg Creek – Duncan Salt Chuck wilderness is one of the exceptions to humans as the vector, as the source of this infestation within the intertidal (418 gross acres) and estuarine (212 gross acres) environment is unknown. Reed canarygrass in the Stikine-LeConte wilderness is now being transported by water as well as humans and spreading up sloughs. Moreover, these are the only infestations within wilderness not associated with a cabin or Special Use site.

Figure 3: Reed canarygrass distribution within the CTP area (denoted by the red polygons)



Table 2: Gross acreage by island. *See #3 “Existing Condition”

Location	Acre
Etolin	431
Kuiu	292
Kupreanof	1,352
Mainland	104
Mitkof	1,110
Wrangell	914
Zarembo	1,207
Other islands	9

Table 3: Gross acreage by land use designations where gross acreage >1.0.

Location	Acre
LUD II	5.2
Modified Landscape	747
Old-growth Habitat	281
Recreational River	117
Resource Natural Area or Special Interest Area	50
Scenic Viewshed	247
Semi-Remote Recreation	49
Timber Production	2060
Wilderness	710
non-NFS lands	1,117

Thomas Bay is notable for not having any invasive plants ranked as moderate or higher by the ACCS along NFS roads. The community of Aggasiz does have one infestation of reed canarygrass (0.1 gross acres) and one infestation of black bindweed (*Fallopia convolvulus*) within a garden (0.0001 gross acres).

The estimated 5,811 gross acres is 0.16% of the project area. When looking at the 12th order Hydrologic Unit Classification (HUC), or drainage basin, the largest proportion of any given watershed infested by invasive plants happens to be the brass buttons in the Duncan Salt Chuck Wilderness. Roughly two percent of the North Arm Duncan Canal – Frontal Duncan Canal watershed is infested – based on gross acres - *including* the infestation below the mean high tide line (Appendix B).

Current Treatments

Invasive species treatments implemented under the Wrangell-Petersburg Weed Management Decision Memo (USDA Forest Service 2013) on the Wrangell and Petersburg Ranger Districts included 37 gross acres of manual and mechanical treatments in 2017, and 147 gross acres of herbicide treatments (estimated at 22.1 canopy acres). In 2018, 25 gross acres of manual and mechanical treatments occurred, with 102 gross acres of herbicide treatments (estimated at 15.2 canopy acres).

The EA assumed a 10 percent annual increase in invasive plant infestations, and an increasing percentage of acreage controlled for any given treatment site (USDA Forest Service 2013). When looking at four riparian restoration treatment sites on the Petersburg Ranger District, the average decrease in canopy acreage after year 1 was 49 percent (predicted 30 percent). After year 2 an additional 15 percent decrease in canopy acreage was measured, although this is conservative because adjacent areas were treated for the first time as well (predicted 20 percent). This provides only one example and is not representative across treatments; however, it shows treatments are out-pacing the expected efficacy. Invasive plant treatments on Etolin Island on the WRD started with 10.8 canopy acres treated in 2015 and decreased to 2.6 canopy acres by 2018 (de Montigny 2019).

METHODS

Spatial Context

The Central Tongass project area is the spatial boundary for analyzing effects and the risk of introduction and/or spread of invasive plants. While the island scale might make the most sense for activity-specific analysis, this large scale analysis, combined with the movement of people between islands, supports analyzing the project area as a whole.

Direct effects include the disturbance footprint. Indirect effects include the area adjacent as openings in the forest canopy alter light, wind and humidity. For example, indirect effects of proposed road construction are analyzed by buffering the 26-meter width of the road corridor by 50 meters and overlaying the buffered area over known invasive plant occurrences. Indirect effects for harvest units are similarly buffered 50 meters from the unit boundary.

Cumulative effects are evaluated based on the maximum proposed disturbance footprint by alternative, combined with the past and present disturbance (Table 4).

Temporal Context

A single growing season is used to bound short-term impacts for assessing direct effects, while any discernible impact beyond a single growing season is considered a long-term effect for assessing indirect and cumulative effects for invasive plants.

Units of Measure

Within the CTP area, the maximum potential disturbance footprint by Alternative is considered in the analysis of effects (Table 4). Because of the difficulty in estimating the amount of disturbance that will be

caused by each alternative, a relative estimate of the maximum total acres of vegetation management, recreation management, watershed improvements and access management are used to compare each alternative's potential for establishment and spread of invasive plants (Krosse 2017). However, it should be noted that the estimated acreage is many times greater than the soil disturbance that would result from these activities. The exception to this is road construction which is a direct source of soil disturbance; therefore, total miles of road construction may be interpreted as a relatively accurate accounting of the level of soil disturbance created as a result of this activity.

Direct, indirect and cumulative effects are characterized as negligible, minor, moderate or major:

- Negligible – The activity footprint is small and/or the activity does not disturb the site such that soil is overturned or the forest canopy is opened.
- Minor – The disturbance opens up habitat to the spread or introduction of invasive plants in the short-term, but impacts are not discernible in the long-term.
- Moderate – The disturbance opens up habitat to the spread or introduction of invasive plants. However, invasive plant species currently exist in the area so there is low probability for introducing new species. Additionally, no high value habitat vulnerable to colonization is present such as riparian corridors, upper beach meadows or wetlands (as contrasted with road prism).
- Major – The disturbance opens up habitat to the spread or introduction of invasive plants in areas where no invasive plants are present and habitat vulnerable to the colonization by invasive plants is also present.

Level of risk is determined from the effects analysis. Risk is categorized as low, medium or high.

- Low risk includes proposed activities that have no invasive plants ranked higher than 60, or activities that are currently being treated or in areas currently being treated, by the District.
- Medium risk includes areas or proposed activities that have invasive plants ranked >60 but do not access vulnerable habitat (e.g., the proposed road goes into a forested habitat that is low risk for colonization by invasive plants).
- High risk includes areas or proposed activities that have invasive plant infestations with a ranking >60 and that are associated with vulnerable habitat (e.g. the proposed road crosses wetlands or riparian systems or is in proximity to sensitive botanical habitat).

Table 4: Maximum potential disturbance footprint of the CTP over the fifteen-year life of the project, as well as general estimates for the disturbance footprint of existing NEPA-cleared activities. Alternatives 2 and 3 are only different with regard to timber harvest and road construction; otherwise the activities are common to both alternatives.

Activity	Proposed Maximum Footprint Alternatives 2 and 3	Past activity – existing footprint	Present activities Alternative 1
Old-growth harvest	Alternative 2: 9,500 acres; Alternative 3: 8,075 acres	154,559 acres	3,321 acres
Young-growth harvest	Alternative 2: 4,000 acres; Alternative 3: 3,640 acres	n/a	n/a
Thinning	3,000 acres annually, 45,000 acres total	78,372 acres	9,634 acres
New road construction	Alternative 2: 25 miles, 80 quarries; Alternative 3: 22 miles, 70 quarries	1,051 miles, including decommissioned roads	2.9 miles
Watershed restoration	700 acres and 13 stream miles with helicopter and heavy equipment; 1,720 acres and 54 stream miles using hand tools		5 hand tool, 2 heavy equipment
Fisheries Enhancement	Fish pass construction, barrier modification, stock and lake fertilization at 15 sites, 25 miles of stream and 2 lakes		-- -- -- --
Invasive plant treatment	5,700 gross acres	182 acres (2017 was the highest acreage treated to date, ~80% with herbicide)	Up to 200 acres annually
Recreation sites	6 new cabins, 30 new day use/picnic areas, 6 platforms, 10 dispersed camp sites, 10 new shelters, 75 outhouses; 300 pedestrian trail miles and 60 motorized trail miles; decommission 15 cabins	42 cabins,	1 trail and observation deck reconstruction
Temp road construction	Alternative 2: 93 miles; Alternative 3: 82 miles	-- --	24 miles
Aquatic organism passage	Alternative 2: 42 new AOP structures; Alternative 3: 37 new AOP structures		The number is based on available funding, level of risk, and presence of associated projects to mobilize the heavy equipment.
Marine Access Facility (MAF)	Construct 5 new MAF sites, maintain/improve 14 existing, and maintain/construct/improve 69 smaller MAF's	14 + 69	n/a
Special Use Permits	Cleared through Categorical Exclusions and are therefore not a proposed action for the CTP. When looking at cumulative effects: These permits range from minerals exploration to communication sites to tent platforms to mariculture facilities. Typically these activities have a small footprint and minimal disturbance. As such, projects go through the Categorical Exclusion process, and impacts to R10 Sensitive plants, if any, are easily mitigated and therefore negligible.		
Outfitters and Guides	Cleared outside of the CTP and are therefore not part of the proposed CTP. When looking at cumulative effects: 88 permits with 29,832 service days were counted in 2018.		

To assess risk, acres of gross infestation, the invasiveness ranking (i.e. the Alaska Center for Conservation Science (ACCS) ranking system), the site type and the presence of vulnerable habitat are considered in conjunction with the disturbance footprint (Table 5). Not all site types are equal even if highly vulnerable for the colonization by invasive plants.

Table 5: Acres of inventoried invasive plants by site type, with associated vulnerable habitat noted.

Site Type	Acres	Current and/ or new vectors to consider	At-risk habitats and vulnerability (Low, Med, High)
Access Management			
Roads	2,934	Current: Vehicle traffic, brushing/mowing, water and wind. New: road construction increases the frequency of current vectors and introduces equipment	Riparian areas at stream crossings (High); Shallow wetland soils (Med)
Marine Access Facilities	44	Current: Vehicle traffic, water, wind. New: construction/maintenance increases the frequency of current vectors and introduces equipment	Well-drained beach meadow (Med to High); Mineral soil (High)
Barrow pits	232	Current: Vehicle traffic, wind. New: construction and maintenance increases the frequency of current vectors and introduces equipment	Disturbed soils (High)
Recreation Management			
Cabins/Shelters/ Trails	21	Current: Vehicle or boat traffic, water, wind, animals. New: construction/maintenance-related activities which increases the frequency of current vectors and introduces equipment	Well-drained beach meadow (Med to High); Lake shore (Med to High); Riparian areas (High)
Watershed Improvement			
Estuaries	630	Current: Boats, minimal foot traffic, wind, water and animals. NEW: Invasive plant treatments = increased foot traffic and introduces equipment	Upper beach meadow, exposed muck (Med to High)
Riparian Management Areas (including road - stream crossings)	442	Current: Water, wind, animals, vehicles and equipment. New: construction/maintenance/restoration-related activities which increase the frequency of occurrence of most current vectors and introduces equipment	River corridors (High); Stream crossings (currently 581) provide opening for invasive plants to entire the stream corridor from roads.
Vegetation Management			
Forested (Volume Class 4-7)	1,727	Current: Vehicle traffic and wind. New: Harvest increases the frequency of current vectors and introduces foot traffic and equipment	Disturbed forest habitat (Low to Mod in the short-term; Low in the long-term)

Analysis Methods

Invasive plant data used for this risk assessment comes from the NRIS TESP-IS database, the AK EPIC database (ACCS 2019), and the invasive inventory data completed by contract for the SEAPA corridor (Meridian 2012). Secondly, the presence of vulnerable high-value habitat by site is coarsely assessed due to the large scale; site-specific review will follow for each activity in accordance with the Implementation Plan. The acreage by site type was obtained from the Tongass National Forest GIS library: wetlands from the soils layer, forest from volume class greater than 3 in the cover type layer, roads and barrow pits from the transportation activities layer, recreation sites from the recreation layer, estuaries from the NWI layer, and stream crossings and 6th order HUC from the hydrology and streams layers.

Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

There are 5,811 gross infestation acres within the project area -- all but roughly 650 gross acres are associated with roads, rock pits, recreation sites and communities. The Catalog of Events in the project record lists the present and foreseeable activities that have an effect on the invasive plants, and every activity has the potential to do so.

The scope and intensity, however, varies. Road construction has the largest effect as the road prism and the increased light availability create available habitat, while the increased traffic serves as a vector for the introduction and spread of invasive plants. Logging operations impact a large acreage; however, the harvesting does not create high vulnerability habitat unless the yarding scarifies the soil and exposes mineral soil. There are presently several sales on-going or ready for bid that include roughly 27 acres of new road connected to existing moderately to highly invasive plants such as reed canarygrass (*Phalaris arundinaceae*) and the hawkweeds (*Hieracium* spp.). Thinning has a negligible to minor contribution to the introduction or spread of invasive plants. Thinning in all young growth stands – predominantly for pre-commercial harvest, but also for fish and wildlife – continues across the project area when stands reach 20-35 years of age.

Pre-Tongass Timber Reform Act (TTRA) harvest occurred to the stream banks in many locations, and oftentimes yarding would occur down the stream corridor. These areas are now assessed for riparian restoration activities, including invasive plants treatments. Reed canarygrass is the predominant target species, as the species has moved into the river corridor from the road system and the disturbance pattern of most floodplain and alluvial fan systems benefits reed canarygrass. Restoration activities are thought to contribute to the control of invasive plants through stabilization of an unraveling system. Past fisheries enhancement activities have had a negligible contribution to the introduction and spread of invasive plants.

Small manual and mechanical invasive plant treatments occurred prior to 2013. Upon completion of the *Wrangell-Petersburg Weed Management Environmental Assessment* (USDA 2013), the ability to use herbicide as a tool expanded treatment efforts. Reed canarygrass, orange and meadow hawkweed and knotweed treatments began after 2013. The reed canarygrass along the Etolin Island road corridor has largely been controlled, with only a handful of sites that still require touch-up treatments (de Montigny 2019). Herbicide treatments associated with knotweed and reed canarygrass on the Petersburg Ranger District have seen an average decrease of 64% in the herbicide applied following two treatments (range of 36% to 83%); this decrease is conservative because a greater area has been treated each year. Anecdotally, infestations that have been present for many years, as well as growing outside of the road prism or sandy/gravelly stream banks, are less responsive to treatments.

The effect of control efforts on Etolin Island over the past four years have reduced the risk of spread related to potential road construction/reconstruction from high to low (Travel Analysis).

Recreation management activities typically impact a small footprint, and are expected to have a negligible to minor contribution to the introduction or spread of invasive plants. The sites increase the number of vectors that enter the natural setting, and habitat becomes invasive-plant friendly with the disturbance footprint and increased light reaching the forest floor. The special use, minerals and outfitter and guide permits, activities not included in the CTP but occurring within the project area likewise have a negligible to minor contribution to the introduction and spread of invasive plants.

Treatment Methods

Hand Pulling

When using this treatment method, targeted plants are pulled or dug up, removing as much of the root system as possible; non-target plants are avoided but may be pulled or dug up along with the targeted species. The process of hand pulling in substantially infested sites may result in considerable vegetation and soil disturbance.

Tarping

When using this treatment method, a plastic tarp is placed directly over patches of target plants; non-target plants cannot be avoided. The tarps are secured to the ground with posts, rocks or various other methods to weigh down the edges of the tarp. Tarps may be left in a treatment area for extended periods of time.

Broadcast Herbicide Spraying

The typical use of this treatment method involves the spraying of herbicide over a heavily infested area. It can also be used as a treatment to the ground as pre-emergent. This method may be used when the invasive plant population is dense enough that it is difficult to discern individual plants and the area to be treated makes spot spraying impractical. The functional difference with spot spraying (definition below) is that the spray is not only directed to the foliage of target plants but may also contact non-target plants.

To minimize impacts to non-target plants, spraying may be timed for when the target plant is still growing and the non-target plants has senesced for the season. When both are still growing, the treatment may be calibrated and timed to be lethal to perennial target plants and not lethal to desirable perennial native plants. Non-target plants are not necessarily negatively affected by a carefully conducted broadcast treatment, but there is more harm potential when compared to spot spraying. The applicator equipment ranges from handheld to backpack sprayers, depending on the overall size of the treatment. Herbicide drift risk is easily managed through droplet size control, but the drift risk potential is positively correlated with equipment and treatment area size.

Spot Herbicide Spraying

When using this treatment method, herbicide is sprayed directly onto small patches or individual target plants; non-target plants are avoided. The applicators range from backpack sprayers to hand-pumped spray or squirt bottles, all of which can target very small plants or parts of plants. Drift is less of a concern because the applicator ensures spray is directed immediately toward the target plant. As infestations increase in density, spot spraying effectively begins a slow gradation toward broadcast spraying.

Hand/Selective

Hand/selective methods treat individual plants, reducing the potential for herbicide to impact soil or non-target organisms. Hand/selective methods include wicking and wiping; foliar application; basal bark treatment; frill, hack and squirt, stem injection, and/or cut-stump methods.

Environmental Consequences

Climate Change

Regardless of the alternative, changes in Southeast Alaska's climate could also create the conditions that encourage the spread of invasive plants by altering opportunities for invasive plants to colonize new areas. Changing climate may also result in range extensions for invasive plant species (Hinzman et al. 2005), and they may become established or become more widespread within the CTP area as a result. Changes in growing conditions would likely favor some plant species and stress others. There is uncertainty in the effect of changes in the climate to the invasive plants in the project area.

Risk of the Introduction or Spread of Invasive Plants

Alternative 1 – No Action

Direct, and Indirect and Cumulative Effects

Under Alternative 1, none of the specific management activities as proposed in the Final EIS would be implemented. Natural disturbances and current management of the project area would continue as before. Ongoing activities such as recreation maintenance and improvements, outfitter and guide use, road and trail maintenance, stream restoration, invasive plant treatments, and other routine forest management activities not associated with the Central Tongass decision would continue as authorized by previous decisions. The Catalog of Events (Appendix C) has a list of the on-going or approved project, and the direct, indirect, cumulative effects and associated level of risk are described in project documents.

Alternatives 2 and 3 – Effects Common to Both Alternatives

All activities outside of timber harvest and associated road construction are common to both alternatives; therefore, the effects for those actions are analyzed together. Where comparisons to existing actions in Alternative 1 are warranted, the details are provided. The effects to invasive plants for Alternatives 2 and 3 are evaluated separately for timber harvest and access management due to the difference in acreage proposed for each alternative.

Ground disturbance associated with the Central Tongass Project provides an opportunity for invasive plant introduction or expansion. All potential activities disturb soil and/or remove existing vegetation, providing opportunities for invasive plants to establish or spread. The impacts of invasive plant spread and colonization can often spread beyond the area of disturbance.

Direct and Indirect Effects

Watershed Improvements

Watershed restoration activities will remove cut logs from the roadside stands, as well as root wads. Increased light reaching the soil is a direct effect of harvest. Additionally, where root wads are removed, mineral soil is exposed. Equipment and personnel working in the area are a vector from a seed source along the road corridor into the stands. Indirectly, removal of timber opens up the stand and exposed soil to windblown seed.

The direct effect of proposed restoration activities within the stream channel will be the movement and exposure of soil during excavation and log placement. Heavy equipment will be moving from access points down into and along the stream channel, directly disturbing soil not protected by corduroy. Equipment and personnel moving from the road corridor into the stream channel and harvest unit are vectors for the dispersal of reed canarygrass and other invasive plant species (likewise for barrier modifications). Indirectly, opening old roads and developing corduroy trails will create open paths in the forest through which wind and equipment could transport seed. On the other hand, stabilizing the stream channel in the long-term will improve habitat for native plants and decrease the likelihood of non-native

plant establishment. With regard to barrier modifications, the indirect effects would be negligible as exposed rock and concrete are not probable habitat for invasive plants.

Overall the direct effects of watershed improvement have a minor effect, but over the long term the indirect effects should be beneficial and therefore negligible. Barrier modification is expected to have a minor direct and negligible indirect effects. The risk is **medium** with regard to the spread or introduction of invasive plants because of the high vulnerability and the high value habitat.

Invasive Plant Treatments

The ability to treat emergent vegetation and assist in treating non-NFS lands increases the opportunity to control invasive plants across southeastern Alaska and more effectively control invasive plants on the Wrangell and Petersburg Ranger Districts. Alternatives 2 and 3 would allow treatment of the brass buttons below the mean high tide line (in coordination with the State of Alaska), as well as riverine and palustrine systems with reed canarygrass that currently require narrow timing windows that coincide with the right water levels (which means that some years the treatment cannot occur).

The direct effect of expanding where treatments can occur by removing the treatment limit and allowing broadcast spray provides a greater flexibility to treat priority areas. Funding and personnel capacity constrains the treatment acres; however, the “all hands all lands” approach ought to have a more successful outcome with increased partnership capabilities and therefore increased treatment capabilities. To summarize, Alternatives 2 and 3 allow for at least 650 more gross acres of invasive plant treatments than Alternative 1 based on habitat. Additional acreage may be treated through partnerships with other land owners to control common non-desirable plant species.

Recreation Management

Ground disturbance associated with cabin, shelter and trail construction, as well as cabin decommissioning, has the direct effect of exposing soil and the understory to light. Opening the road to ATV/UTV use introduces more vehicular traffic that may contain invasive seed. These activities all increase the likelihood of introducing invasive plants. These activities have the indirect effect of increasing public user days, and people and their equipment act as vectors for the introduction and spread of invasive plants. Minor direct and indirect effects are expected. Recreation sites typically occur in high vulnerability, high-value sites such as the upper beach meadow, lake shores, and within the riparian corridor. As a result, the risk is **medium** for the spread or introduction of invasive plants.

Vegetation Management

Thinning to benefit timber production, or wildlife and riparian resources have negligible direct and indirect effects as the thinning does not disturb the soil. The risk is **low**.

Alternatives 2 and 3 –Timber Harvest and Access Management

Direct and Indirect Effects

Vegetation Management

The direct and indirect effects related to old-growth harvest are stated in Alternative 1. Alternative 2 proposes 13,500 acres of harvest – 9,000 acres of old-growth and 4,500 acres of young-growth timber whereas Alternative 3 proposes 11,725 acres – 8,000 acres old-growth and 3,715 acres of young-growth timber harvest. Alternative 2’s harvest footprint is 1,775 acres greater - 1,000 of those acres in old-growth habitat - than Alternative 3. The risk is **medium** because of the high risk, high vulnerability habitat adjacent to and traveled through during harvest activities. Moderately to highly invasive plants are present in most watersheds proposed for harvest.

Access Management

The direct and indirect effects of road construction, maintenance and reconstruction are the same as those stated in Alternative 1. Alternative 2 would directly impact 5,813 acres whereas Alternative 3 would

impact 5,116 acres. Alternative 2 proposes developing or improving 80 borrow pits while Alternative 3 proposed 70. The risk of spread or introduction of invasive plants is **high** for most NFS roads because infestations occur along the road corridor, and the road corridor crosses high value and high vulnerability habitat or connects with high value habitat.

Cumulative Effects

In addition to the present and foreseeable activities summarized in Table 5/the Catalog of Events in the project record, the State of Alaska, Mental Health Trust and Sealaska hold lands that could include old-growth harvest in the future as could the State of Alaska intertie/road corridor easements.

Collectively, the cumulative effects of the activities proposed in the Central Tongass Project range from a negligible to a moderate impact on the risk of introduction or spread of invasive plants within the project area (Table). Invasive plant treatments and riparian restoration activities should have the beneficial effect of restoring natural habitat and decreasing the presence of both the invasive plants and the conditions that favor invasive plant growth. Other watershed improvement activities such as barrier modifications or lake enrichment will not likely contribute to the cumulative risk of spread. Similarly, thinning is not likely to cumulatively contribute to the risk of spread since it is geared to move forested areas to more mature stands which are less hospitable to invasive plants.

Table 4. Summary of effects and risk of invasive plant introduction and spread for each category of activity in the Central Tongass Project

Activity category	Alternatives 2 and 3			
	Direct Effect	Indirect Effect	Cumulative Effect	Risk
Watershed Improvement	Minor	Negligible	Negligible	Low to Med
Recreation Management	Minor	Minor	Minor	Med
Vegetation Management	Alt 2 > Alt 3 Moderate for both	Alt 2 > Alt 3. Moderate for both	Moderate	Low to Med
Access Management	Alt 2 > Alt 3. Moderate for both.	Alt 2 > Alt 3. Moderate for both.	Moderate	Med to High

Summary of Effects:

Alternative 2 has the greatest amount of proposed harvest and the greatest amount of road construction; therefore, the greatest risk of the introduction or spread of invasive plants. Alternative 3 follows. Alternative 1 has the lowest risk; however, timber harvest can still be proposed under Alternative 1 but along the lines of the traditional NEPA process.

Continuation of invasive plant control efforts decreases the risk of the introduction or spread, as observed on Etolin Island where the risk of spread is considered minor because invasive plant treatments have been on-going and successful in controlling target invasive plants. Efforts to control and eradicate reed canarygrass have been relatively successful in all but a handful of locations over the five-year treatment period. The ability to treat emergent vegetation will allow for additional treatments in ponded areas on the road system to complete the control/eradication effort.

Mitigation/Design Features and Monitoring

Following weed BMPs (Krosse 2017) will minimize the likelihood of the introduction and spread of invasive plants. Invasive plant surveys will be conducted and activity-specific project design features will be detailed during the site-specific review in accordance with the CT project Implementation Guide.

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Appendix A: Invasive plants documented within the CTP area with the ACCS ranking and acreage infestation.

<u>Scientific Name</u>	<u>Common Name</u>	<u>ACCS Ranking</u>	<u>Acres</u>
<i>Achillea ptarmica</i> L.	sneezeweed	46	0.01
<i>Aegopodium podagraria</i> L.	bishop's goutweed	57	0.002
<i>Agrostis capillaris</i> L.	colonial bentgrass	NR	0.3
<i>Agrostis gigantea</i> Roth	redtop	NR	0.3
<i>Agrostis stolonifera</i> L.	creeping bentgrass	NR	0.7
<i>Alchemilla mollis</i> (Buser) Rothm	lady's mantle	56	0.03
<i>Alchemilla monticola</i> Opiz	hairy lady's mantle	56	0.1
<i>Alopecurus geniculatus</i> L.	water foxtail	49	0.01
<i>Alopecurus pratensis</i> L.	meadow foxtail	52	0.01
<i>Anthemis cotula</i> L.	stinking chamomile	NR	0.01
<i>Anthoxanthum odoratum</i> L.	sweet vernalgrass	NR	0.01
<i>Brassica rapa</i> L.	field mustard	50	0.001
<i>Bromus inermis</i> Leyss.	smooth brome	62	0.4
<i>Calendula officinalis</i> L.	Pot marigold	NR	0.001
<i>Capsella bursa-pastoris</i> (L.) Medik.	shepherd's purse	40	0.01
<i>Centaurea stoebe</i> L.	spotted knapweed	86	0.4
<i>Cerastium fontanum</i> Baumg. ssp. <i>vulgare</i> (Hartm.) Greuter & Burdet	big chickweed	36	22.3
<i>Cerastium glomeratum</i> Thuill.	sticky chickweed	36	0.01
<i>Cirsium arvense</i> (L.) Scop.	Canada thistle	76	0.1
<i>Cirsium vulgare</i> (Savi) Ten.	bull thistle	61	6.1
<i>Cotula coronopifolia</i> L.	brass buttons	40	630
<i>Crepis capillaris</i> (L.) Wallr.	smooth hawksbeard	NR	0.2
<i>Crepis tectorum</i> L.	narrowleaf hawksbeard	56	0.01
<i>Cytisus scoparius</i> (L.) Link	Scotch broom	69	0.1
<i>Dactylis glomerata</i> L.	orchardgrass	53	5.6
<i>Daucus carota</i> L.	Queen Anne's lace	NR	0.001
<i>Deschampsia elongata</i> (Hook.) Munro	slender hairgrass	35	0.05
<i>Digitalis purpurea</i> L.	purple foxglove	51	0.6
<i>Euphrasia nemorosa</i> (Pers.) Wallr.	common eyebright	42	1.0
<i>Galeopsis bifida</i> Boenn.	split-lip hempnettle	50	0.01
<i>Geranium robertianum</i> L.	Robert geranium	67	0.05
<i>Gnaphalium palustre</i> Nutt.	western marsh cudweed	NR	0.01
<i>Hesperis matronalis</i> L.	dame's rocket	41	0.01
<i>Hieracium aurantiacum</i> L.	orange hawkweed	79	171.8
<i>Hieracium caespitosum</i> Dumort.	meadow hawkweed	79	1.2
<i>Hieracium lachenalii</i> C.C. Gmel.	common hawkweed	57	83.2
<i>Hieracium murorum</i> L.	wall hawkweed	NR	37.1
<i>Hieracium umbellatum</i> L.	narrowleaf hawkweed	51	25.5
<i>Hordeum jubatum</i> L.	foxtail barley	63	0.001
<i>Holcus lanatus</i> L.	common velvetgrass	56	1.3
<i>Hypericum perforatum</i> L.	common St. Johnswort	52	0.04
<i>Hypochaeris radicata</i> L.	hairy cat's ear	44	6.2
<i>Iris pseudacorus</i> L.	pale yellow iris	66	0.4

<i>Lapsana communis</i> L.	common nipplewort	33	0.02
<i>Leontodon autumnalis</i> L.	fall dandelion	51	0.2
<i>Leucanthemum maximum</i> (Ramond) DC.	chrysanthemum	NR	0.01
<i>Leucanthemum vulgare</i> Lam.	oxeye daisy	61	276.1
<i>Lotus corniculatus</i> L.	bird's foot trefoil	65	0.5
<i>Lolium perenne</i> L. ssp. <i>multiflorum</i> (Lam.) Husnot	Italian ryegrass	41	0.7
<i>Lolium perenne</i> L. ssp. <i>perenne</i>	perennial ryegrass	52	0.4
<i>Lupinus polyphyllus</i> Lindl. ssp. <i>polyphyllus</i> var. <i>polyphyllus</i>	bigleaf lupine	71	0.08
<i>Matricaria discoidea</i> DC.	disc mayweed	32	5.3
<i>Medicago lupulina</i> L.	black medic	48	0.002
<i>Melilotus officinalis</i> (L.) Lam.	sweet clover	69	13.4
<i>Mycelis muralis</i> (L.) Dumort.	wall lettuce	31	8.7
<i>Myosotis scorpioides</i> L.	true forget-me-not	54	2.6
<i>Phalaris arundinacea</i> L.	reed canarygrass	83	3805.8
<i>Phalaris canariensis</i> L.	annual canarygrass	NR	0.4
<i>Phleum pratense</i> L.	timothy	54	43.4
<i>Plantago major</i> L.	common plantain	44	55.1
<i>Poa annua</i> L.	annual bluegrass	46	19.1
<i>Poa compressa</i> L.	Canada bluegrass	39	0.6
<i>Poa pratensis</i> L.	Kentucky bluegrass	52	7.5
<i>Poa trivialis</i> L.	rough bluegrass	52	0.4
<i>Polygonum ×bohemicum</i> (J. Chrtek & Chrtková) Zika & Jacobson [<i>cuspidatum</i> × <i>sachalinense</i>] (<i>Fallopia ×bohemica</i> (J. Chrtek & Chrtkov) J.P. Bailey)	Bohemian knotweed	87	0.8
<i>Polygonum cuspidatum</i> Siebold & Zucc. (<i>Fallopia japonica</i> (Houtt.) Ronse Decr.)	Japanese knotweed	87	19.8
<i>Ranunculus acris</i> L.	tall buttercup	60	0.06
<i>Ranunculus repens</i> L.	creeping buttercup	72	31.5
<i>Rumex acetosella</i> L.	common sheep sorrel	51	0.5
<i>Rumex crispus</i> L.	curly dock	48	0.09
<i>Rumex obtusifolius</i> L.	bitter dock	48	0.02
<i>Sagina procumbens</i> L.	birdeye pearlwort	39	0.01
<i>Schedonorus arundinaceus</i> (Schreb.) Dumort., nom. cons.	tall fescue	63	6.7
<i>Senecio jacobaea</i> L.	stinking willie	63	0.1
<i>Senecio vulgaris</i> L.	old-man-in-the-spring	36	0.7
<i>Sonchus asper</i> (L.) Hill	spiny sowthistle	46	0.3
<i>Sonchus oleraceus</i> L.	common sowthistle	46	0.07
<i>Sorbus aucuparia</i> L.	European mtn. ash	59	0.3
<i>Stellaria media</i> (L.) Vill	common chickweed	42	0.01
<i>Symphytum officinale</i> L. Show All Show Tabs	common comfry	48	0.004
<i>Tanacetum vulgare</i> L.	common tansy	60	0.3
<i>Taraxacum officinale</i> F.H. Wigg.	common dandelion	58	63.9
<i>Thlaspi arvense</i> L. Show All Show Tabs	field pennycress	42	0.001
<i>Triticum aestivum</i> L.	common wheat	NR	0.001
<i>Trifolium aureum</i> Pollich	golden clover	NR	0.001
<i>Trifolium hybridum</i> L.	alsike clover	57	10.2

<i>Trifolium pratense</i> L.	red clover	53	1.2
<i>Trifolium repens</i> L.	white clover	59	44.1
<i>Veronica serpyllifolia</i> L. ssp. <i>serpyllifolia</i>	thymeleaf speedwell	36	0.5

Appendix B: Gross acreage invasive plants by 6th order HUC

HUC Name	District	Island	Ownership	Gross Acres
Southwest Cove-Frontal Ernest Sound	WRD	Brownson	NFS	0.03
Lake Helen-Frontal Seward Passage	WRD	Deer	NFS	0.01
Stikine River-Frontal Stikine Strait	PRD/WRD	Dry, Kadin, Mainland, Mitkof, Sergief, Vank	Mix	139.8
190102090201-Helen Peak	WRD	Etolin	NFS	44.4
Anita Bay-Frontal Zimovia Strait	WRD	Etolin	NFS	210.7
Burnett Inlet-Frontal Rocky Bay	WRD	Etolin	NFS	37.3
Mosman Inlet-Frontal Rocky Bay	WRD	Etolin, Mainland	NFS	49.5
Pat Creek-Frontal Zimovia Strait	WRD	Etolin, Wrangell, Woronkofski	Mix	397.6
Chichagof Pass-Frontal Stikine Strait	WRD	Etolin, Zarembo, Woronkofski	NFS	312.2
Bay of Pillars-Frontal Chatham Strait	PRD	Kuiu	NFS	10.0
Dean Creek-Frontal Frederick Sound	PRD	Kuiu	Mix	20.6
Kadake Creek	PRD	Kuiu	NFS	100.3
Port Camden-Frontal Keku Strait	PRD	Kuiu	NFS	14
Rowan Bay-Frontal Chatham Strait	PRD	Kuiu	NFS	14.2
Saginaw Bay-Frontal Frederick Sound	PRD	Kuiu	Mix	8.7
Saginaw Creek	PRD	Kuiu	NFS	21.6
Security Bay-Frontal Frederick Sound	PRD	Kuiu	NFS	17
Straight Creek	PRD	Kuiu	NFS	25.9
Threemile Arm-Frontal Keku Strait	PRD	Kuiu	NFS	6.2
Washington Bay-Frontal Chatham Strait	PRD	Kuiu	NFS	0.1
Big Creek	PRD	Kupreanof	NFS	3.6
Big John Bay-Frontal Rocky Pass	PRD	Kupreanof	NFS	52.2
Big John Creek	PRD	Kupreanof	NFS	46.4
Bohemian Range-Frontal Frederick Sound	PRD	Kupreanof	NFS	17.9
Cathedral Falls Creek	PRD	Kupreanof	Mix	50.9
Chipp Peak-Frontal Frederick Sound	PRD	Kupreanof	NFS	36
Fivemile Creek-Frontal Frederick Sound	PRD	Kupreanof	NFS	0.7
Goose Cove	PRD	Kupreanof	NFS	89

Gunnuck Creek	PRD	Kupreanof	non-NFS	3.8
Hamilton Bay	PRD	Kupreanof	NFS	26.7
Headwaters Castle River	PRD	Kupreanof	NFS	9.5
Headwaters Hamilton Creek	PRD	Kupreanof	NFS	7.9
Irish Creek	PRD	Kupreanof	NFS	14.3
Keku Strait-Frontal Frederick Sound	PRD	Kupreanof	NFS	33.4
North Arm Duncan Canal-Frontal Duncan Canal	PRD	Kupreanof	NFS	46.1
Outlet Hamilton Creek	PRD	Kupreanof	NFS	99.4
Petersburg Creek	PRD	Kupreanof	NFS	2.3
Pinta Point	PRD	Kupreanof	Non-NFS	4.3
Portage Bay-Frontal Frederick Sound	PRD	Kupreanof	NFS	42.6
Sitkum Creek	PRD	Kupreanof	Mix	24.1
Towers Arm-Frontal Duncan Canal	PRD	Kupreanof	NFS	0.1
Tunehean Creek	PRD	Kupreanof	NFS	16.7
Turn Mountain	PRD	Kupreanof	non-NFS	0.1
Twelvemile Creek	PRD	Kupreanof	NFS	19.7
190102E+11	PRD/WRD	Kupreanof, Zarembo, Kuiu, Mainland	Mixed	496.5
Anan Creek	WRD	Mainland	NFS	4.5
Andrew Creek	WRD	Mainland	NFS	0.7
Farragut River	PRD	Mainland	NFS	0.5
Ketili Creek	WRD	Mainland	NFS	14.5
Ketili River-Stikine River	WRD	Mainland	NFS	15.2
Kikahe River	WRD	Mainland	NFS	1.9
Shakes Slough	WRD	Mainland	NFS	0.03
190102100101-Big Creek	PRD	Mitkof	NFS	71
190102101201-Sumner Mountains	PRD	Mitkof	NFS	27.6
Blind River	PRD	Mitkof	Mix	124.6
Falls Creek	PRD	Mitkof	Mix	77.3
Mitkof Island-Frontal Frederick Sound	PRD	Mitkof	Mix	178
Ohmer Creek-Frontal Blind Slough	PRD	Mitkof	Mix	117.8
Woodpecker Cove	PRD	Mitkof	Mix	96.8
Colorado Creek-Frontal Wrangell Narrows	PRD	Mitkof, Kupreanof, Woewodski	Mix	283.3
North Arm-Frontal Frederick Sound	PRD/WRD	Mitkof, Mainland	NFS	60.3
Sunrise Lake-Frontal Sumner Strait	WRD	Woronkofski, Wrangell	Mix	95.8

Earl West Creek	WRD	Wrangell	Mix	43.6
Fools Inlet-Frontal Ernest Sound	WRD	Wrangell	NFS	72.5
Salamander Creek	WRD	Wrangell	NFS	140.9
Thoms Creek	WRD	Wrangell	Mix	38.1
Wrangell Island-Frontal Blake Channel	WRD	Wrangell	NFS	0.5
Wrangell Island-Frontal Eastern Passage	WRD	Wrangell	Mix	171.2
Saint John Harbor	WRD	Zarembo	Mix	237.5
Snow Passage-Frontal Clarence Strait	WRD	Zarembo	NFS	82.9
Baht Harbor-Frontal Sumner Strait	WRD	Zarembo	Mix	227.4